

## **Cruise Report**

### **U.S. Geological Survey Cruise Report 2018-677-FA**

**October 9 – 12, 2018**

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**USGS**

## **Summary**

During October 9 – 12, 2018, the Pacific Coastal and Marine Science Center of the U.S. Geological Survey (USGS) conducted a survey collecting bathymetry data offshore of the Santa Cruz County shoreline, from Point Santa Cruz to the Moss Landing Harbor jetty. The work was conducted using personal water craft (PWC) out of the Santa Cruz and Moss Landing harbors. This survey is part of a series designed to document changes in shoreline position and coastal morphology in northern Monterey Bay related to episodic, seasonal and interannual processes.

The majority of the California coastline is actively eroding and major storms (El Niño) have caused significant shoreline retreat and property damage. During the next 100 years sea level is projected to rise ~1 m in California (NRC, 2012), making it increasingly important to understand the complex sediment transport and sedimentation patterns that control beach morphodynamics. The West Coast of the United States is among the least understood of the coastal environments, because high wave energy has limited the use of traditional monitoring methods used to study processes controlling sediment transport. The Santa Cruz Littoral Cell has a wide range of coastal morphologic settings, wave exposure, river influences, levels of coastal development and flooding vulnerabilities, making it an excellent opportunity to understand how different sites respond on storm and interannual time scales. This research project has received authorization through the Monterey Bay National Marine Sanctuary under permit **MBNMS-2017-010-A1** and the California Department of Parks and Recreation.

The USGS research 2018-677-FA took place from October 9 – 12, 2018. All operations took place during daylight hours between 09:23 AM and 1:20 PM Pacific Standard Time (PST). Bathymetric mapping was conducted using two PWCs, each equipped with a 200 kHz single beam echosounder and a GPS receiver. In accordance with the MBNMS permit, the vessels launched from either Santa Cruz or Moss Landing harbor and transited directly to the survey sites from Point Santa Cruz (Figure 1) to Moss Landing Harbor (Figure 2) and operated at speeds at, or less than, 4 knots once at the survey site. Fueling occurred prior to launching the vessels and did not land on the shoreline. Prior to operation, the U.S. Coast Guard and two MBNMS points of contact were notified of the plan and purpose for the survey. Figures 1 & 2 show the location of the survey track lines, with track line time and starting and ending locations listed in Table 1. Weather observations are provided in Appendix A and marine wildlife observations are provided in Appendix B. Exhibit H is provided in Appendix C.

## **References**

National Research Council, 2012. Sea-Level Rise for the Coastal of California, Oregon, and Washington: Past, Present, and Future. Washington, DC: The National Academies Press.

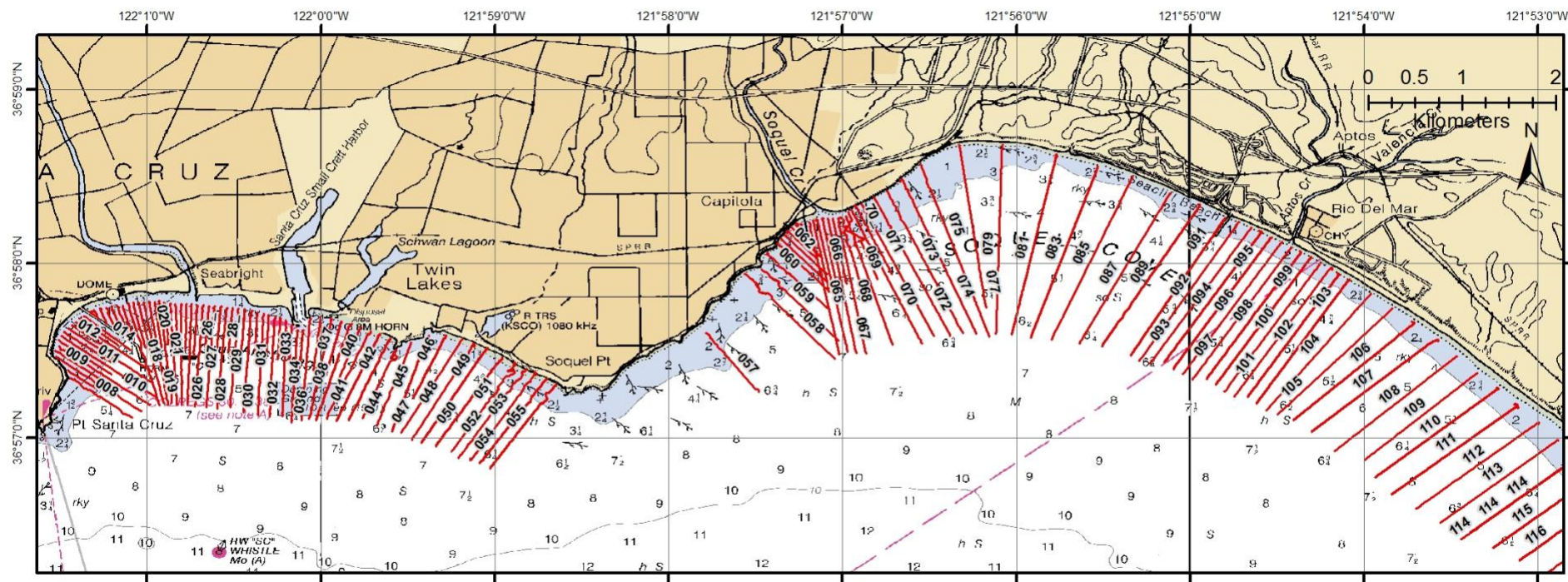


Figure 1. Northern extent of bathymetric data locations collected from October 9 – 12, 2018 offshore of Santa Cruz County. Map projection is UTM Zone 10, meters.

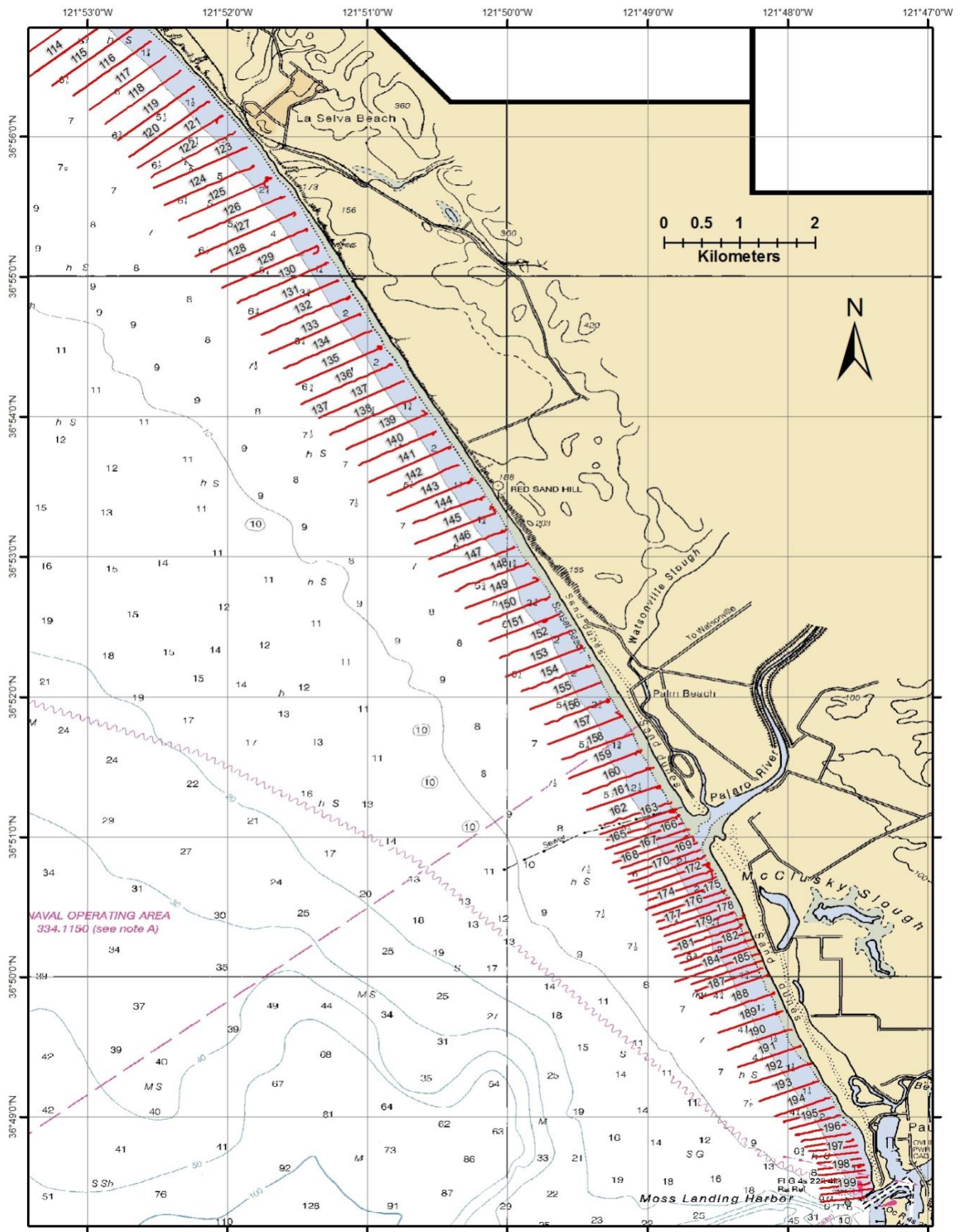


Figure 2. Southern extent of bathymetric data locations collected from October 9 – 12, 2018 offshore of Santa Cruz County. Map projection is UTM Zone 10, meters.

Table 1. Survey track information.

Line #	Date	Start Time (PST)	Starting Latitude	Starting Longitude	End Time (PST)	Ending Latitude	Ending Longitude
008	10/9/2018	9:19:36 AM	36.951941	-122.018146	9:24:21 AM	36.955704	-122.024148
008	10/9/2018	9:20:53 AM	36.954647	-122.021493	9:22:52 AM	36.956465	-122.024356
009	10/9/2018	9:24:18 AM	36.958353	-122.025531	9:27:30 AM	36.955237	-122.020672
10_1	10/9/2018	9:28:22 AM	36.956033	-122.020141	9:31:25 AM	36.959356	-122.025183
009	10/9/2018	9:29:32 AM	36.957746	-122.025482	9:34:34 AM	36.95251	-122.017271
11_1	10/9/2018	9:32:14 AM	36.960109	-122.024699	9:35:03 AM	36.957152	-122.020085
010	10/9/2018	9:41:04 AM	36.953146	-122.016408	9:47:06 AM	36.958775	-122.025165
12_1	10/9/2018	9:41:19 AM	36.957823	-122.019385	9:44:15 AM	36.960783	-122.023896
13_1	10/9/2018	9:44:58 AM	36.961427	-122.023238	9:47:33 AM	36.958806	-122.019462
011	10/9/2018	9:48:06 AM	36.959741	-122.024994	9:53:53 AM	36.953835	-122.015756
014	10/9/2018	9:48:51 AM	36.958384	-122.018321	9:51:44 AM	36.961576	-122.022838
013	10/9/2018	9:52:43 AM	36.961068	-122.023598	9:56:49 AM	36.956306	-122.016241
012	10/9/2018	9:54:35 AM	36.955291	-122.016183	9:59:38 AM	36.960493	-122.024288
15_1	10/9/2018	10:03:33 AM	36.960984	-122.020639	10:04:35 AM	36.962324	-122.021103
15_1	10/9/2018	10:04:09 AM	36.960888	-122.020615	10:04:13 AM	36.960927	-122.020651
015	10/9/2018	10:04:45 AM	36.9614	-122.02138	10:05:27 AM	36.962228	-122.021813
15_1	10/9/2018	10:05:34 AM	36.96215	-122.021796	10:06:12 AM	36.961634	-122.02162
16_1	10/9/2018	10:05:38 AM	36.962595	-122.020144	10:07:40 AM	36.95976	-122.018971
016	10/9/2018	10:06:51 AM	36.962412	-122.020696	10:08:18 AM	36.960303	-122.019744
17_1	10/9/2018	10:08:47 AM	36.959294	-122.017979	10:11:00 AM	36.962629	-122.019065
017	10/9/2018	10:09:22 AM	36.959582	-122.01837	10:09:59 AM	36.960362	-122.018767
017	10/9/2018	10:10:56 AM	36.959571	-122.018367	10:12:51 AM	36.962659	-122.019616
18_1	10/9/2018	10:11:42 AM	36.962915	-122.018061	10:14:31 AM	36.958603	-122.016919
018	10/9/2018	10:13:26 AM	36.962825	-122.01856	10:19:48 AM	36.9531	-122.015546
19_1	10/9/2018	10:15:06 AM	36.958552	-122.016089	10:17:41 AM	36.962913	-122.016968
20_1	10/9/2018	10:18:19 AM	36.963001	-122.016022	10:21:18 AM	36.958625	-122.015341
019	10/9/2018	10:20:11 AM	36.953254	-122.015091	10:26:06 AM	36.963016	-122.017596
21_1	10/9/2018	10:23:42 AM	36.958926	-122.014644	10:26:14 AM	36.962906	-122.015124
020	10/9/2018	10:26:41 AM	36.963083	-122.016544	10:32:30 AM	36.953119	-122.014716
022	10/9/2018	10:27:07 AM	36.962854	-122.014485	10:33:32 AM	36.9531	-122.01387
021	10/9/2018	10:34:52 AM	36.953333	-122.014357	10:40:45 AM	36.963115	-122.01556
023	10/9/2018	10:36:49 AM	36.953078	-122.013418	10:42:21 AM	36.962677	-122.013393
022	10/9/2018	10:41:51 AM	36.962279	-122.014509	10:47:08 AM	36.953134	-122.013898
22_1	10/9/2018	10:44:04 AM	36.962783	-122.014043	10:46:41 AM	36.958555	-122.013844
23_1	10/9/2018	10:47:15 AM	36.958437	-122.013054	10:49:54 AM	36.962766	-122.012904
024	10/9/2018	10:47:45 AM	36.953195	-122.012835	10:53:19 AM	36.962824	-122.01246
24_1	10/9/2018	10:50:51 AM	36.962541	-122.01194	10:53:32 AM	36.957878	-122.012232
025	10/9/2018	10:54:28 AM	36.962738	-122.011328	11:00:29 AM	36.952983	-122.012166
25_1	10/9/2018	10:54:30 AM	36.95841	-122.011164	10:57:01 AM	36.962516	-122.010743
26_1	10/9/2018	10:57:51 AM	36.962579	-122.009622	11:00:39 AM	36.958243	-122.010066
026	10/9/2018	11:01:11 AM	36.952922	-122.011021	11:07:12 AM	36.962598	-122.010212
27_1	10/9/2018	11:01:22 AM	36.958167	-122.008904	11:04:07 AM	36.96236	-122.008537
28_1	10/9/2018	11:04:48 AM	36.962303	-122.007379	11:07:27 AM	36.957975	-122.007732
027	10/9/2018	11:08:02 AM	36.962458	-122.00905	11:13:52 AM	36.952734	-122.009988
29_1	10/9/2018	11:08:20 AM	36.957868	-122.006389	11:10:59 AM	36.961967	-122.006099
30_1	10/9/2018	11:11:40 AM	36.961731	-122.005078	11:14:18 AM	36.957624	-122.005296



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31_1	10/9/2018	11:15:09 AM	36.957506	-122.004185	11:17:43 AM	36.961207	-122.003934
32_1	10/9/2018	11:18:56 AM	36.960789	-122.002846	11:21:11 AM	36.957193	-122.003092
029	10/9/2018	11:21:18 AM	36.962153	-122.006708	11:27:10 AM	36.952413	-122.00745
032	10/9/2018	11:28:22 AM	36.952023	-122.003785	11:34:10 AM	36.961253	-122.003454
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33_1	10/9/2018	11:47:45 AM	36.960305	-122.001694	11:50:10 AM	36.956673	-122.002093
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039	10/9/2018	12:00:37 PM	36.955479	-121.998382	12:03:47 PM	36.960391	-121.996286
038	10/9/2018	12:03:40 PM	36.96092	-121.997084	12:08:59 PM	36.951603	-122.00052
041	10/9/2018	12:04:45 PM	36.959909	-121.994413	12:10:01 PM	36.95158	-121.998566
040	10/9/2018	12:10:14 PM	36.951803	-121.99947	12:16:05 PM	36.960226	-121.995264
043	10/9/2018	12:11:01 PM	36.95183	-121.996046	12:17:17 PM	36.958289	-121.992853
042	10/9/2018	12:19:31 PM	36.95955	-121.993409	12:24:38 PM	36.951637	-121.997388
045	10/9/2018	12:20:20 PM	36.959802	-121.989706	12:26:44 PM	36.950571	-121.993233
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048	10/9/2018	12:38:29 PM	36.949761	-121.991316	12:45:04 PM	36.959064	-121.98536
051	10/9/2018	12:42:50 PM	36.948629	-121.987528	12:49:27 PM	36.956962	-121.981577
050	10/9/2018	12:46:18 PM	36.957703	-121.98266	12:52:07 PM	36.949132	-121.989013
052	10/9/2018	12:57:21 PM	36.948018	-121.986858	1:04:03 PM	36.956613	-121.980316
053	10/9/2018	1:00:32 PM	36.947815	-121.985708	1:06:27 PM	36.956224	-121.979454
054	10/9/2018	1:05:21 PM	36.955666	-121.978302	1:11:17 PM	36.947536	-121.984804
053	10/9/2018	1:06:28 PM	36.956228	-121.979478	1:06:39 PM	36.955928	-121.979417
055	10/9/2018	1:07:36 PM	36.955122	-121.977484	1:13:55 PM	36.947058	-121.983814
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058	10/10/2018	9:41:38 AM	36.957551	-121.950741	9:49:34 AM	36.965708	-121.95937
059	10/10/2018	9:47:33 AM	36.966114	-121.957728	9:53:35 AM	36.959288	-121.950395
060	10/10/2018	9:50:32 AM	36.967507	-121.957295	9:55:24 AM	36.962218	-121.95124
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063	10/10/2018	10:03:59 AM	36.967357	-121.952126	10:06:13 AM	36.970209	-121.954904
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067	10/10/2018	10:16:26 AM	36.9581	-121.948647	10:23:33 AM	36.971002	-121.951423
63_1	10/10/2018	10:18:33 AM	36.969122	-121.953369	10:19:38 AM	36.970315	-121.954343
63_1	10/10/2018	10:19:38 AM	36.970308	-121.954337	10:19:41 AM	36.970254	-121.954302
065	10/10/2018	10:23:48 AM	36.958	-121.950279	10:31:13 AM	36.970646	-121.953208
66_1	10/10/2018	10:24:02 AM	36.970985	-121.951811	10:28:04 AM	36.964702	-121.950587

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67_1	10/10/2018	10:36:55 AM	36.964726	-121.949625	10:40:32 AM	36.970987	-121.950919
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070	10/10/2018	10:47:16 AM	36.959047	-121.942384	10:57:57 AM	36.971872	-121.9492
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072	10/10/2018	11:06:19 AM	36.95974	-121.939666	11:15:43 AM	36.973045	-121.947012
073	10/10/2018	11:11:00 AM	36.959974	-121.938422	11:19:24 AM	36.973677	-121.945756
074	10/10/2018	11:16:43 AM	36.974537	-121.944463	11:27:15 AM	36.959971	-121.937169
075	10/10/2018	11:21:34 AM	36.976274	-121.942549	11:31:52 AM	36.959756	-121.935956
077	10/10/2018	11:28:18 AM	36.962438	-121.936245	11:37:55 AM	36.9781	-121.938829
075	10/10/2018	11:31:52 AM	36.959744	-121.935951	11:31:56 AM	36.959637	-121.935902
079	10/10/2018	11:32:26 AM	36.959911	-121.935275	11:43:03 AM	36.978071	-121.934612
081	10/10/2018	11:40:50 AM	36.977195	-121.929553	11:41:21 AM	36.97659	-121.929592
081	10/10/2018	11:41:51 AM	36.977099	-121.929589	11:51:55 AM	36.959841	-121.933775
083	10/10/2018	11:44:59 AM	36.976001	-121.925502	11:54:52 AM	36.95959	-121.931927
087	10/10/2018	11:58:34 AM	36.959045	-121.927253	12:08:39 PM	36.973362	-121.918523
085	10/10/2018	11:58:37 AM	36.959383	-121.929944	12:08:03 PM	36.975043	-121.922172
089	10/10/2018	12:09:38 PM	36.972376	-121.915898	12:18:49 PM	36.958721	-121.92512
091	10/10/2018	12:10:21 PM	36.971099	-121.913292	12:19:33 PM	36.957873	-121.92235
092	10/10/2018	12:20:00 PM	36.957353	-121.921547	12:28:54 PM	36.970675	-121.911976
093	10/10/2018	12:20:36 PM	36.95707	-121.920517	12:29:25 PM	36.970083	-121.910765
094	10/10/2018	12:29:36 PM	36.969815	-121.910036	12:38:23 PM	36.957196	-121.919138
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096	10/10/2018	12:38:54 PM	36.956077	-121.917398	12:46:51 PM	36.96877	-121.907823
097	10/10/2018	12:39:46 PM	36.95556	-121.916419	12:47:42 PM	36.968193	-121.90689
098	10/10/2018	12:47:58 PM	36.967875	-121.906169	12:56:44 PM	36.955602	-121.915072
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100	10/10/2018	12:57:19 PM	36.954438	-121.913383	1:05:13 PM	36.96679	-121.904074
101	10/10/2018	12:57:30 PM	36.95393	-121.912434	1:05:21 PM	36.966107	-121.903017
102	10/10/2018	1:05:52 PM	36.965762	-121.902515	1:14:17 PM	36.953858	-121.911139
103	10/10/2018	1:06:19 PM	36.965195	-121.901385	1:14:16 PM	36.953271	-121.910282
104	10/10/2018	1:14:52 PM	36.952615	-121.909358	1:23:00 PM	36.963833	-121.89931
105	10/10/2018	1:14:57 PM	36.952167	-121.908269	1:22:35 PM	36.962388	-121.897213
106	10/10/2018	1:24:02 PM	36.961113	-121.89542	1:31:40 PM	36.951653	-121.906729
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108	10/10/2018	1:32:46 PM	36.948693	-121.902836	1:40:30 PM	36.957807	-121.891049
109	10/10/2018	1:33:42 PM	36.947846	-121.899914	1:40:07 PM	36.95619	-121.889061
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110	10/10/2018	1:42:22 PM	36.954799	-121.887232	1:49:46 PM	36.946169	-121.89888
112	10/10/2018	1:51:27 PM	36.943197	-121.895	1:58:11 PM	36.951424	-121.883177
113	10/10/2018	1:53:44 PM	36.941812	-121.892639	2:00:14 PM	36.949665	-121.881357
114	10/10/2018	2:00:06 PM	36.948255	-121.879574	2:06:55 PM	36.94093	-121.889679
114	10/10/2018	2:01:08 PM	36.948062	-121.879622	2:07:29 PM	36.940944	-121.889631
114	10/11/2018	9:23:13 AM	36.940238	-121.890659	9:29:49 AM	36.947725	-121.879392
114	10/11/2018	9:27:20 AM	36.940951	-121.889754	9:33:14 AM	36.947323	-121.879467
115	10/11/2018	9:31:18 AM	36.946336	-121.877899	9:38:34 AM	36.9394	-121.887577

116	10/11/2018	9:34:38 AM	36.944627	-121.875822	9:40:00 AM	36.938193	-121.885035
117	10/11/2018	9:40:23 AM	36.936552	-121.88311	9:45:31 AM	36.942972	-121.874065
118	10/11/2018	9:41:10 AM	36.934846	-121.881253	9:46:32 AM	36.941232	-121.87224
119	10/11/2018	9:47:08 AM	36.939255	-121.870822	9:52:48 AM	36.932905	-121.879752
120	10/11/2018	9:48:48 AM	36.937359	-121.868915	9:54:44 AM	36.93093	-121.878356
121	10/11/2018	9:54:06 AM	36.929619	-121.877402	10:00:04 AM	36.93493	-121.867927
122	10/11/2018	9:55:47 AM	36.928475	-121.875745	10:01:18 AM	36.933987	-121.865799
123	10/11/2018	10:01:26 AM	36.931769	-121.865147	10:07:36 AM	36.92723	-121.87547
124	10/11/2018	10:03:05 AM	36.929644	-121.863808	10:08:31 AM	36.925197	-121.874177
125	10/11/2018	10:09:01 AM	36.923394	-121.872463	10:15:21 AM	36.927232	-121.862057
126	10/11/2018	10:09:28 AM	36.921348	-121.871323	10:15:28 AM	36.926215	-121.859859
127	10/11/2018	10:16:35 AM	36.923885	-121.858773	10:22:59 AM	36.919105	-121.870487
128	10/11/2018	10:19:28 AM	36.922094	-121.857265	10:25:21 AM	36.91724	-121.868591
129	10/11/2018	10:25:14 AM	36.915375	-121.867295	10:30:50 AM	36.919663	-121.855986
130	10/11/2018	10:26:45 AM	36.913572	-121.865504	10:32:54 AM	36.918364	-121.8547
129	10/11/2018	10:30:51 AM	36.919643	-121.855998	10:31:03 AM	36.919432	-121.856413
131	10/11/2018	10:32:35 AM	36.916148	-121.853585	10:38:11 AM	36.911631	-121.864176
132	10/11/2018	10:34:31 AM	36.913954	-121.852508	10:40:18 AM	36.909772	-121.862596
133	10/11/2018	10:39:31 AM	36.907565	-121.861745	10:45:18 AM	36.91209	-121.850903
134	10/11/2018	10:41:26 AM	36.90581	-121.859954	10:46:26 AM	36.910293	-121.849521
135	10/11/2018	10:47:03 AM	36.908039	-121.848483	10:53:54 AM	36.903836	-121.858554
136	10/11/2018	10:49:57 AM	36.906281	-121.847444	10:55:48 AM	36.901506	-121.857915
137	10/11/2018	10:55:18 AM	36.899901	-121.855809	10:56:23 AM	36.900361	-121.854754
138	10/11/2018	10:56:46 AM	36.897891	-121.854482	11:01:55 AM	36.902373	-121.8443
137	10/11/2018	11:00:13 AM	36.90018	-121.855215	11:05:21 AM	36.904191	-121.845745
139	10/11/2018	11:07:32 AM	36.896152	-121.852533	11:12:40 AM	36.90073	-121.843529
140	10/11/2018	11:09:09 AM	36.894261	-121.851045	11:14:52 AM	36.8983	-121.841841
141	10/11/2018	11:15:03 AM	36.89225	-121.849824	11:20:16 AM	36.896224	-121.84032
142	10/11/2018	11:16:47 AM	36.890684	-121.84765	11:21:32 AM	36.894263	-121.839136
143	10/11/2018	11:23:13 AM	36.888797	-121.84652	11:28:22 AM	36.892095	-121.838036
144	10/11/2018	11:23:53 AM	36.887323	-121.844549	11:28:27 AM	36.890569	-121.836113
145	10/11/2018	11:30:38 AM	36.884925	-121.844345	11:35:16 AM	36.889023	-121.835425
146	10/11/2018	11:31:31 AM	36.883069	-121.842673	11:37:00 AM	36.886662	-121.833546
147	10/11/2018	11:38:50 AM	36.881016	-121.84152	11:43:51 AM	36.88457	-121.832683
148	10/11/2018	11:39:21 AM	36.879273	-121.839584	11:44:04 AM	36.882589	-121.830876
149	10/11/2018	11:46:19 AM	36.877247	-121.838361	11:50:54 AM	36.880779	-121.830302
150	10/11/2018	11:46:48 AM	36.87536	-121.83678	11:51:25 AM	36.87863	-121.828385
151	10/11/2018	11:53:02 AM	36.873327	-121.835509	11:57:29 AM	36.876548	-121.827315
152	10/11/2018	11:53:21 AM	36.871332	-121.834239	11:57:20 AM	36.874568	-121.825804
153	10/11/2018	11:59:19 AM	36.869099	-121.83354	12:04:05 PM	36.872733	-121.824669
154_1	10/11/2018	11:59:51 AM	36.86735	-121.831695	12:05:17 PM	36.870432	-121.823182
155	10/11/2018	12:06:16 PM	36.86521	-121.830681	12:10:16 PM	36.868394	-121.822277
156	10/11/2018	12:07:05 PM	36.86345	-121.828933	12:12:04 PM	36.866403	-121.821226
157	10/11/2018	12:12:34 PM	36.861057	-121.82853	12:17:36 PM	36.864821	-121.820472
158	10/11/2018	12:13:58 PM	36.859248	-121.826895	12:17:59 PM	36.86226	-121.818328
159	10/11/2018	12:19:27 PM	36.856992	-121.82603	12:24:03 PM	36.859841	-121.818111
160	10/11/2018	12:19:53 PM	36.855178	-121.824406	12:25:00 PM	36.858309	-121.815915
161	10/11/2018	12:25:55 PM	36.853238	-121.823884	12:30:29 PM	36.855794	-121.815595
162	10/11/2018	12:26:59 PM	36.851381	-121.822406	12:27:04 PM	36.851405	-121.8222
162	10/11/2018	12:27:20 PM	36.851431	-121.821849	12:31:29 PM	36.854155	-121.813843

163	10/11/2018	12:32:52 PM	36.850326	-121.822361	12:38:25 PM	36.85304	-121.813626
164	10/11/2018	12:33:28 PM	36.849667	-121.821511	12:38:30 PM	36.852662	-121.812983
165	10/11/2018	12:40:31 PM	36.848571	-121.82174	12:44:50 PM	36.85169	-121.812538
166	10/11/2018	12:40:44 PM	36.848035	-121.820584	12:45:27 PM	36.8509	-121.811724
167	10/11/2018	12:47:06 PM	36.846924	-121.820818	12:52:33 PM	36.849543	-121.811177
168	10/11/2018	12:47:20 PM	36.846274	-121.819854	12:51:46 PM	36.849357	-121.810772
170	10/11/2018	12:53:44 PM	36.844655	-121.818942	12:58:36 PM	36.847869	-121.809897
169	10/11/2018	12:54:11 PM	36.845597	-121.819028	12:58:20 PM	36.848508	-121.810467
171	10/11/2018	1:00:18 PM	36.843917	-121.818174	1:06:02 PM	36.84433	-121.809626
172	10/11/2018	1:00:30 PM	36.843176	-121.817599	1:04:45 PM	36.84609	-121.808891
174	10/11/2018	1:06:26 PM	36.841635	-121.8164	1:11:06 PM	36.844239	-121.808027
173	10/11/2018	1:16:01 PM	36.842465	-121.816665	1:20:07 PM	36.845261	-121.808635
174	10/12/2018	10:54:08 AM	36.841406	-121.816875	10:59:00 AM	36.844351	-121.808197
174	10/12/2018	10:59:11 AM	36.841539	-121.816574	11:03:10 AM	36.844226	-121.808224
175	10/12/2018	11:00:28 AM	36.843581	-121.80758	11:04:55 AM	36.8407	-121.81608
176	10/12/2018	11:04:15 AM	36.842688	-121.807082	11:08:15 AM	36.839887	-121.815629
177	10/12/2018	11:05:46 AM	36.839057	-121.815292	11:10:49 AM	36.841992	-121.80646
178	10/12/2018	11:08:50 AM	36.838195	-121.814712	11:13:22 AM	36.841056	-121.806406
179	10/12/2018	11:12:46 AM	36.840635	-121.805428	11:17:38 AM	36.83743	-121.814225
180	10/12/2018	11:15:06 AM	36.839602	-121.805648	11:19:31 AM	36.836615	-121.813716
181	10/12/2018	11:18:22 AM	36.83573	-121.813425	11:22:36 AM	36.838681	-121.804731
182	10/12/2018	11:20:31 AM	36.834997	-121.8128	11:25:31 AM	36.8379	-121.804218
183	10/12/2018	11:24:26 AM	36.836942	-121.803933	11:28:50 AM	36.834154	-121.812277
184	10/12/2018	11:26:34 AM	36.836046	-121.803515	11:31:39 AM	36.832799	-121.81342
185	10/12/2018	11:29:24 AM	36.832482	-121.811453	11:33:42 AM	36.835293	-121.803135
186	10/12/2018	11:32:16 AM	36.831712	-121.810974	11:36:20 AM	36.834406	-121.802989
187	10/12/2018	11:35:10 AM	36.833527	-121.802407	11:39:33 AM	36.830851	-121.810492
188	10/12/2018	11:37:57 AM	36.831293	-121.801782	11:41:54 AM	36.828855	-121.809198
189	10/12/2018	11:41:58 AM	36.826739	-121.808264	11:46:27 AM	36.829314	-121.800614
190	10/12/2018	11:45:15 AM	36.824659	-121.807121	11:48:52 AM	36.827093	-121.799525
191	10/12/2018	11:48:53 AM	36.825086	-121.798498	11:53:02 AM	36.822638	-121.80592
192	10/12/2018	11:50:11 AM	36.822972	-121.797281	11:53:47 AM	36.820738	-121.804545
193	10/12/2018	11:54:18 AM	36.818605	-121.803371	11:57:54 AM	36.820994	-121.796349
194	10/12/2018	11:54:47 AM	36.816736	-121.801566	11:58:27 AM	36.818943	-121.795014
194_1	10/12/2018	12:00:11 PM	36.81604	-121.800504	12:00:42 PM	36.816293	-121.799805
195	10/12/2018	12:01:30 PM	36.815274	-121.799764	12:04:36 PM	36.816921	-121.793754
194_1	10/12/2018	12:01:39 PM	36.816143	-121.800496	12:04:35 PM	36.817894	-121.794513
196	10/12/2018	12:06:02 PM	36.813737	-121.798352	12:09:02 PM	36.814778	-121.792517
195_1	10/12/2018	12:06:02 PM	36.814497	-121.799079	12:10:03 PM	36.815814	-121.793116
196_2	10/12/2018	12:10:16 PM	36.812674	-121.79745	12:12:54 PM	36.81332	-121.79175
197	10/12/2018	12:11:44 PM	36.811924	-121.796916	12:14:15 PM	36.812529	-121.791609
196_1	10/12/2018	12:13:14 PM	36.813905	-121.792233	12:15:48 PM	36.813137	-121.797961
197_1	10/12/2018	12:15:35 PM	36.81121	-121.796531	12:18:08 PM	36.811763	-121.791288
198	10/12/2018	12:16:48 PM	36.809759	-121.796346	12:19:25 PM	36.810317	-121.790812
197_2	10/12/2018	12:19:00 PM	36.810933	-121.791063	12:22:52 PM	36.810449	-121.796395
198_1	10/12/2018	12:20:38 PM	36.80893	-121.795982	12:23:18 PM	36.809578	-121.790512
198_2	10/12/2018	12:24:16 PM	36.808783	-121.790397	12:27:13 PM	36.80816	-121.796186
199	10/12/2018	12:24:28 PM	36.807403	-121.796058	12:27:28 PM	36.808137	-121.789948
200	10/12/2018	12:28:11 PM	36.807155	-121.7911	12:31:22 PM	36.806596	-121.795996



## **Appendix A: Weather Observation Forms**

### Marine Environmental Variables Form

Dates: 10/9/2018 – 10/12/2018

Date	Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Monitors
10/9	9:35 am	36.954042°	-122.021489°	Survey	Overcast	Overcast	None	3 nm	Light	Ripple	2-3 ft	J. Lovering, D. Hoover
10/10	10:24 am	36.966679°	-121.953360°	Survey	Overcast	Overcast	None	5 nm	Light	Calm	1-2 ft	J. Lovering, A. Snyder
10/11	9:31 am	36.945347°	-121.879202°	Survey	Overcast	Overcast	None	5+ nm	Light	Calm	2-3+ ft	A. Stevens, D. Nowacki
10/12	11:00 am	36.958749°	-122.020066°	Survey	Sunny	Clear	Mild	2 nm	Light	Calm	1-2 ft	J. Lovering, D. Hoover

## **Appendix B: Marine Wildlife Observations**

## Marine Wildlife Observations Form

Date: 10/9/2018

Monitor: J. Lovering, D. Hoover

Time: 9:35 am	Latitude: 36.954042°	Longitude: -122.021489°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 3 nm	Wind Speed: Light	Sea State: Ripple
Swell Height: 2-3 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Seal observed.		
Time: 10:24 am	Latitude: 36.962772°	Longitude: -122.016497°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 3 nm	Wind Speed: Light	Sea State: Ripple
Swell Height: 2-3 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Sea lion observed.		
Time: 12:14 am	Latitude: 36.957678°	Longitude: -121.993403°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 3 nm	Wind Speed: Light	Sea State: Ripple
Swell Height: 2-3 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
7 sea otters observed.		
Time: 12:23 am	Latitude: 36.957289°	Longitude: -121.994224°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 3 nm	Wind Speed: Light	Sea State: Ripple
Swell Height: 2-3 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Seal observed.		
Time: 12:31 am	Latitude: 36.948077°	Longitude: -122.021489°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 3 nm	Wind Speed: Light	Sea State: Ripple
Swell Height: 2-3 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Whales observed offshore of survey area.		
Time: 1:06 pm	Latitude: 36.947348°	Longitude: -121.984826°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 3 nm	Wind Speed: Light	Sea State: Ripple
Swell Height: 2-3 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Dolphin observed.		

10/10/2018

### Marine Wildlife Observations Form

Date: 10/10/2018

Monitor: J. Lovering, A. Snyder

Time: 9:59 am	Latitude: 36.966679°	Longitude: -121.953360°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 5+ nm	Wind Speed: Light	Sea State: Calm
Swell Height: 1-2 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Otter observed.		
Time: 11:11 am	Latitude: 36.969826°	Longitude: -121.943694°
Weather: Sunny	Cloud Cover: None	Glare: Mild
Visibility: 5+ nm	Wind Speed: Light	Sea State: Calm
Swell Height: 1-2 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Otter observed.		
Time: 1:20 pm	Latitude: 36.958471°	Longitude: -121.898236°
Weather: Sunny	Cloud Cover: None	Glare: Mild
Visibility: 5+ nm	Wind Speed: Light	Sea State: Calm
Swell Height: 1-2 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Whale observed.		

10/11/2018

# **Marine Wildlife Observations Form**

Date: 10/11/2018

Monitor: A. Stevens, D. Nowacki

Time: 9:31 am	Latitude: 36.945347°	Longitude: -121.879202°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 5+ nm	Wind Speed: Light	Sea State: calm
Swell Height: 2-3+ feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Porpoise observed.		
Time: 9:46 am	Latitude: 36.935137°	Longitude: -121.872179°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 5+ nm	Wind Speed: Light	Sea State: calm
Swell Height: 2-3+ feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Porpoise observed.		
Time: 11:34 am	Latitude: 36.883669°	Longitude: -121.834543°
Weather: Sunny	Cloud Cover: None	Glare: Mild
Visibility: 5+ nm	Wind Speed: Light	Sea State: calm
Swell Height: 2-3+ feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Whales observed.		
Time: 12:59 am	Latitude: 36.845835°	Longitude: -121.812464°
Weather: Sunny	Cloud Cover: None	Glare: Mild
Visibility: 5+ nm	Wind Speed: Light	Sea State: calm
Swell Height: 2-3+ feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Otter observed.		



## **Appendix C: Exhibit H**




## EXHIBIT H

## Mitigation Monitoring Program

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
<b>Air Quality and Greenhouse Gas (GHG) Emissions (MND Section 3.3.3)</b>						
<b>MM AIR-1: Engine Tuning, Engine Certification, and Fuels.</b> The following measures will be required to be implemented by all Permittees under the Offshore Geophysical Permit Program (OGPP), as applicable depending on the county offshore which a survey is being conducted. Pursuant to section 93118.5 of CARB's Airborne Toxic Control Measures, the Tier 2 engine requirement applies only to diesel-fueled vessels.	<u>All Counties:</u> Maintain all construction equipment in proper tune according to manufacturers' specifications; fuel all off-road and portable diesel-powered equipment with California Air Resources Board (CARB)-certified motor vehicle diesel fuel limiting sulfur content to 15 parts per million or less (CARB Diesel).	Daily emissions of criteria pollutants during survey activities are minimized.	Determine engine certification of vessel engines.	OGPP permit holder and contract vessel operator; California State Lands Commission (CSLC) review of Final Monitoring Report.	Prior to, during, and after survey activities.  Submit Final Monitoring Report after completion of survey activities.	9/18 9/18/18 TCE
	<u>Los Angeles and Orange Counties:</u> Use vessel engines meeting CARB's Tier 2-certified engines or cleaner; the survey shall be operated such that daily NO <sub>x</sub> emissions do not exceed 100 pounds based on engine certification emission factors. This can be accomplished with Tier 2 engines if daily fuel use is 585 gallons or less, and with Tier 3 engines if daily fuel use is 935 gallons or less.		Verify that Tier 2 or cleaner engines are being used.  Calculate daily NO <sub>x</sub> emissions to verify compliance with limitations.			
	<u>San Luis Obispo County:</u> Use vessel engines meeting CARB's Tier 2-certified engines or cleaner, accomplished with Tier 2 engines if daily fuel use is 585 gallons or less; all diesel equipment shall not idle for more than 5 minutes; engine use needed to maintain position in the water is not considered idling; diesel idling within 300 meters (1,000 feet) of sensitive receptors is not permitted; use alternatively fueled construction equipment on site where feasible, such as compressed natural gas, liquefied natural gas, propane or biodiesel.		Verify that Tier 2 or cleaner engines are being used.  Inform vessel operator(s) of idling limitation.  Investigate availability of alternative fuels.			
	<u>Santa Barbara County:</u> Use vessel engines meeting CARB's Tier 2-certified engines or cleaner, accomplished with Tier 2 engines if daily fuel use is 790 gallons or less.		Verify that Tier 2 or cleaner engines are being used.  Investigate availability of alternative fuels.			
	<u>Ventura County:</u> Use alternatively fueled construction equipment on site where feasible, such as compressed natural gas, liquefied natural gas, propane or biodiesel.		Investigate availability of alternative fuels.			


## EXHIBIT H

## Mitigation Monitoring Program

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
<b>MM BIO-1:</b> Marine Mammal and Sea Turtle Presence – Current Information.	All State waters; prior to commencement of survey operations, the geophysical operator shall: (1) contact the National Oceanic and Atmospheric Administration Long Beach office staff and local whale-watching operations and shall acquire information on the current composition and relative abundance of marine wildlife offshore, and (2) convey sightings data to the vessel operator and crew, survey party chief, and onboard Marine Wildlife Monitors (MWMs) prior to departure. This information will aid the MWMs by providing data on the approximate number and types of organisms that may be in the area.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Document contact with appropriate sources.  Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder; Inquiry to NOAA and local whale watching operators.	Prior to survey.	9/18/18 
<b>MM BIO-2:</b> Marine Wildlife Monitors (MWMs).	Except as provided in section 7(h) of the General Permit, a minimum of two (2) qualified MWMs who are experienced in marine wildlife observations shall be onboard the survey vessel throughout both transit and data collection activities. The specific monitoring, observation, and data collection responsibilities shall be identified in the Marine Wildlife Contingency Plan required as part of all Offshore Geophysical Permit Program permits. Qualifications of proposed MWMs shall be submitted to the National Oceanic and Atmospheric Administration (NOAA) and CSLC at least twenty-one (21) days in advance of the survey for their approval by the agencies. Survey operations shall not commence until the CSLC approves the MWMs.	Competent and professional monitoring or marine mammals and sea turtles; compliance with established monitoring policies.	Document contact with and approval by appropriate agencies.  Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	9/18/18 
<b>MM BIO-3:</b> Safety Zone Monitoring.	Onboard Marine Wildlife Monitors (MWMs) responsible for observations during vessel transit shall be responsible for monitoring during the survey equipment operations. All visual monitoring shall occur from the highest practical vantage point aboard the survey vessel; binoculars shall be used to observe the surrounding area, as appropriate. The MWMs will survey an area (i.e., safety or exclusion zone) based on the equipment used, centered on the sound source (i.e., vessel, towfish), throughout time that the survey equipment is operating. Safety zone radial distances, by equipment type, include:	No adverse effects to marine mammals or sea turtles due to survey activities are observed; compliance with established safety zones.	Compliance with permit requirements (observers); compliance with established safety zones.  Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	9/18/18 



## EXHIBIT H

## Mitigation Monitoring Program

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials												
	<table><tr><th>Equipment Type</th><th>Safety Zone (radius, m)</th></tr><tr><td>Single Beam Echosounder</td><td>50</td></tr><tr><td>Multibeam Echosounder</td><td>500</td></tr><tr><td>Side-Scan Sonar</td><td>600</td></tr><tr><td>Subbottom Profiler</td><td>100</td></tr><tr><td>Boomer System</td><td>100</td></tr></table> <p>If the geophysical survey equipment is operated at or above a frequency of 200 kilohertz (kHz), safety zone monitoring and enforcement is not required; however, if geophysical survey equipment operated at a frequency at or above 200 kHz is used simultaneously with geophysical survey equipment less than 200 kHz, then the safety zone for the equipment less than 200 kHz must be monitored. The onboard MWMs shall have authority to stop operations if a mammal or turtle is observed within the specified safety zone and may be negatively affected by survey activities. The MWMs shall also have authority to recommend continuation (or cessation) of operations during periods of limited visibility (i.e., fog, rain) based on the observed abundance of marine wildlife. Periodic reevaluation of weather conditions and reassessment of the continuation/cessation recommendation shall be completed by the onboard MWMs. During operations, if an animal's actions are observed to be irregular, the monitor shall have authority to recommend that equipment be shut down until the animal moves further away from the sound source. If irregular behavior is observed, the equipment shall be shut-off and will be restarted and ramped-up to full power, as applicable, or will not be started until the animal(s) is/are outside of the safety zone or have not been observed for 15 minutes.</p> <p>For nearshore survey operations utilizing vessels that lack the personnel capacity to hold two (2) MWMs aboard during survey operations, at least twenty-one (21) days prior to the commencement of survey activities, the Permittee may petition the CSLC to conduct survey operations with one (1) MWM aboard. The CSLC will consider such authorization on a case-by-case basis and</p>	Equipment Type	Safety Zone (radius, m)	Single Beam Echosounder	50	Multibeam Echosounder	500	Side-Scan Sonar	600	Subbottom Profiler	100	Boomer System	100					9/18/18 
Equipment Type	Safety Zone (radius, m)																	
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	factors the CSLC will consider will include the timing, type, and location of the survey, the size of the vessel, and the availability of alternate vessels for conducting the proposed survey. CSLC authorizations under this subsection will be limited to individual surveys and under any such authorization; the Permittee shall update the MWCP to reflect how survey operations will occur under the authorization.					
<b>MM BIO-4:</b> Limits on Nighttime OGPP Surveys.	All State waters; nighttime survey operations are prohibited under the OGPP, except as provided below. The CSLC will consider the use of single beam echosounders and passive equipment types at night on a case-by-case basis, taking into consideration the equipment specifications, location, timing, and duration of survey activity.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Presurvey request for nighttime operations, including equipment specifications and proposed use schedule.  Document equipment use.  Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Approval required before survey is initiated.  Monitoring Report following completion of survey.	9/18/18 
<b>MM BIO-5:</b> Soft Start.	All State waters; the survey operator shall use a "soft start" technique at the beginning of survey activities each day (or following a shut down) to allow any marine mammal that may be in the immediate area to leave before the sound sources reach full energy. Surveys shall not commence at nighttime or when the safety zone cannot be effectively monitored. Operators shall initiate each piece of equipment at the lowest practical sound level, increasing output in such a manner as to increase in steps not exceeding approximately 6 decibels (dB) per 5-minute period. During ramp-up, the Marine Wildlife Monitors (MWMs) shall monitor the safety zone. If marine mammals are sighted within or about to enter the safety zone, a power-down or shut down shall be implemented as though the equipment was operating at full power. Initiation of ramp-up procedures from shut down requires that the MWMs be able to visually observe the full safety zone.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Compliance with permit requirements (observers); compliance with safe start procedures.  Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Immediately prior to survey.	10/9/18 

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<b>MM BIO-6:</b> Practical Limitations on Equipment Use and Adherence to Equipment Manufacturer's Routine Maintenance Schedule.	<p>All State waters; geophysical operators shall follow, to the maximum extent possible, the guidelines of Zykov (2013) as they pertain to the use of subbottom profilers and side-scan sonar, including:</p> <ul style="list-style-type: none"> <li>Using the highest frequency band possible for the subbottom profiler;</li> <li>Using the shortest possible pulse length; and</li> <li>Lowering the pulse rate (pings per second) as much as feasible.</li> </ul> <p>Geophysical operators shall consider the potential applicability of these measures to other equipment types (e.g., boomer). Permit holders will conduct routine inspection and maintenance of acoustic-generating equipment to ensure that low energy geophysical equipment used during permitted survey activities remains in proper working order and within manufacturer's equipment specifications. Verification of the date and occurrence of such equipment inspection and maintenance shall be provided in the required presurvey notification to CSLC.</p>	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	<p>Document initial and during survey equipment settings.</p> <p>Submit Final Monitoring Report after completion of survey activities.</p>	OGPP permit holder.	Immediately prior to and during survey.	<p>10/9/18</p> <p>TCE</p>
<b>MM BIO-7:</b> Avoidance of Pinniped Haul-Out Sites.	<p>The Marine Wildlife Contingency Plan (MWCP) developed and implemented for each survey shall include identification of haul-out sites within or immediately adjacent to the proposed survey area. For surveys within 300 meters (m) of a haul-out site, the MWCP shall further require that:</p> <ul style="list-style-type: none"> <li>The survey vessel shall not approach within 91 m of a haul-out site, consistent with National Marine Fisheries Service (NMFS) guidelines;</li> <li>Survey activity close to haul-out sites shall be conducted in an expedited manner to minimize the potential for disturbance of pinnipeds on land; and</li> <li>Marine Wildlife Monitors shall monitor pinniped activity onshore as the vessel approaches, observing and reporting on the number of pinnipeds potentially disturbed (e.g., via head lifting, flushing into the water). The purpose of such reporting is to provide CSLC and California Department of Fish and Wildlife (CDFW) with information regarding potential disturbance associated with OGPP surveys.</li> </ul>	No adverse effects to pinnipeds at haul outs are observed.	<p>Document pinniped reactions to vessel presence and equipment use.</p> <p>Submit Final Monitoring Report after completion of survey activities.</p>	OGPP permit holder.	Monitoring Report following completion of survey.	<p>10/13/18</p> <p>TCE</p>



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<b>MM BIO-8:</b> Reporting Requirements – Collision.	<p>All State waters; if a collision with marine mammal or reptile occurs, the vessel operator shall document the conditions under which the accident occurred, including the following:</p> <ul style="list-style-type: none"> <li>Vessel location (latitude, longitude) when the collision occurred;</li> <li>Date and time of collision;</li> <li>Speed and heading of the vessel at the time of collision;</li> <li>Observation conditions (e.g., wind speed and direction, swell height, visibility in miles or kilometers, and presence of rain or fog) at the time of collision;</li> <li>Species of marine wildlife contacted (if known);</li> <li>Whether an observer was monitoring marine wildlife at the time of collision; and,</li> <li>Name of vessel, vessel owner/operator, and captain officer in charge of the vessel at time of collision.</li> </ul> <p>After a collision, the vessel shall stop, if safe to do so; however, the vessel is not obligated to stand by and may proceed after confirming that it will not further damage the animal by doing so. The vessel will then immediately communicate by radio or telephone all details to the vessel's base of operations, and shall immediately report the incident. Consistent with Marine Mammal Protection Act requirements, the vessel's base of operations or, if an onboard telephone is available, the vessel captain him/herself, will then immediately call the National Oceanic and Atmospheric Administration (NOAA) Stranding Coordinator to report the collision and follow any subsequent instructions. From the report, the Stranding Coordinator will coordinate subsequent action, including enlisting the aid of marine mammal rescue organizations, if appropriate. From the vessel's base of operations, a telephone call will be placed to the Stranding Coordinator, NOAA National Marine Fisheries Service (NMFS), Southwest Region, Long Beach, to obtain instructions. Although NOAA has primary responsibility for marine mammals in both State and Federal waters, the California Department of Fish and Wildlife (CDFW) will also be advised that an incident has occurred in State waters affecting a protected species.</p>	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Monitoring Report following completion of survey.	<p>10/13/18</p> 


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<b>MM BIO-9:</b> Limitations on Survey Operations in Select Marine Protected Areas (MPAs).	All MPAs; prior to commencing survey activities, geophysical operators shall coordinate with the CSLC, California Department of Fish and Wildlife (CDFW), and any other appropriate permitting agency regarding proposed operations within MPAs. The scope and purpose of each survey proposed within a MPA shall be defined by the permit holder, and the applicability of the survey to the allowable MPA activities shall be delineated by the permit holder. If deemed necessary by CDFW, geophysical operators will pursue a scientific collecting permit, or other appropriate authorization, to secure approval to work within a MPA, and shall provide a copy of such authorization to the CSLC as part of the required presurvey notification to CSLC. CSLC, CDFW, and/or other permitting agencies may impose further restrictions on survey activities as conditions of approval.	No adverse effects to MPA resources due to survey activities are observed.	Monitor reactions of wildlife to survey operations; report on shutdown conditions and survey restart.  Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder; survey permitted by CDFW.	Prior to survey.	9/18/18 TCE
<b>MM HAZ-1:</b> Oil Spill Contingency Plan (OSCP) Required Information.	Permittees shall develop and submit to CSLC staff for review and approval an OSCP that addresses accidental releases of petroleum and/or non-petroleum products during survey operations. Permittees' OSCPs shall include the following information for each vessel to be involved with the survey: <ul style="list-style-type: none"> <li>Specific steps to be taken in the event of a spill, including notification names, phone numbers, and locations of: (1) nearby emergency medical facilities, and (2) wildlife rescue/response organizations (e.g., Oiled Wildlife Care Network);</li> <li>Description of crew training and equipment testing procedures; and</li> <li>Description, quantities, and location of spill response equipment onboard the vessel.</li> </ul>	Reduction in the potential for an accidental spill. Proper and timely response and notification of responsible parties in the event of a spill.	Documentation of proper spill training.  Notification of responsible parties in the event of a spill.	OGPP permit holder and contract vessel operator.	Prior to survey.	9/18/18 TCE
<b>MM HAZ-2:</b> Vessel fueling restrictions.	Vessel fueling shall only occur at an approved docking facility. No cross vessel fueling shall be allowed.	Reduction in the potential for an accidental spill.	Documentation of fueling activities.	Contract vessel operator.	Following survey.	10/9-10/12 TCE
<b>MM HAZ-3:</b> OSCP equipment and supplies.	Onboard spill response equipment and supplies shall be sufficient to contain and recover the worst-case scenario spill of petroleum products as outlined in the OSCP.	Proper and timely response in the event of a spill.	Notification to CSLC of onboard spill response equipment/supplies inventory, verify	Contract vessel operator.	Prior to survey.	10/9/18 TCE



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			ability to respond to worst-case spill.			
<b>MM HAZ-1:</b> Oil Spill Contingency Plan (OSCP) Required Information.	Outlined under <b>Hazards and Hazardous Materials</b> (above)					
<b>MM HAZ-2:</b> Vessel fueling restrictions.	Outlined under <b>Hazards and Hazardous Materials</b> (above)					
<b>MM HAZ-3:</b> OSCP equipment and supplies.	Outlined under <b>Hazards and Hazardous Materials</b> (above)					
<b>MM BIO-9:</b> Limitations on Survey Operations in Select MPAs.	Outlined under <b>Biological Resources</b> (above)					
<b>MM REC-1:</b> U.S. Coast Guard (USCG), Harbormaster, and Dive Shop Operator Notification.	All California waters where recreational diving may occur; as a survey permit condition, the CSLC shall require Permittees to provide the USCG with survey details, including information on vessel types, survey locations, times, contact information, and other details of activities that may pose a hazard to divers so that USCG can include the information in the Local Notice to Mariners, advising vessels to avoid potential hazards near survey areas. Furthermore, at least twenty-one (21) days in advance of in-water activities, Permittees shall: (1) post such notices in the harbormasters' offices of regional harbors; and (2) notify operators of dive shops in coastal locations adjacent to the proposed offshore survey operations.	No adverse effects to recreational divers from survey operations.	Notify the USCG, local harbormasters, and local dive shops of planned survey activity.  Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	9/18/18 

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*Mitigation Monitoring Program*

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
<b>MM FISH-1:</b> U.S. Coast Guard (USCG) and Harbormaster Notification.	All California waters; as a survey permit condition, the CSLC shall require Permittees to provide the USCG with survey details, including information on vessel types, survey locations, times, contact information, and other details of activities that may pose a hazard to mariners and fishers so that USCG can include the information in the Local Notice to Mariners, advising vessels to avoid potential hazards near survey areas. Furthermore, at least twenty-one (21) days in advance of in-water activities, Permittees shall post such notices in the harbormasters' offices of regional harbors.	No adverse effects to commercial fishing gear in place.	Notify the USCG and local harbormasters of planned survey activity.  Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	9/18/18 
<b>MM FISH-2:</b> Minimize Interaction with Fishing Gear.	To minimize interaction with fishing gear that may be present within a survey area: (1) the geophysical vessel (or designated vessel) shall traverse the proposed survey corridor prior to commencing survey operations to note and record the presence, type, and location of deployed fishing gear (i.e., buoys); (2) no survey lines within 30 m (100 feet) of observed fishing gear shall be conducted. The survey crew shall not remove or relocate any fishing gear; removal or relocation shall only be accomplished by the owner of the gear upon notification by the survey operator of the potential conflict.	No adverse effects to commercial fishing gear in place.	Visually observe the survey area for commercial fishing gear. Notify the gear owner and request relocation of gear outside survey area.  Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Immediately prior to survey (prior to each survey day).	10/9/18 
<b>MM FISH-1:</b> USCG and Harbormaster Notification.	Outlined under <b>Commercial and Recreational Fisheries</b> (above)					

Acronyms/Abbreviations: CARB = California Air Resources Board; CDFW = California Department of Fish and Wildlife; CSLC = California State Lands Commission; dB = decibels; kHz = kilohertz; MPA = Marine Protected Area; MWCP = Marine Wildlife Contingency Plan; MWM = Marine Wildlife Monitor; m= meter(s); NOAA = National Oceanic and Atmospheric Administration; NO<sub>x</sub> = Nitrogen Oxide; OGPP = Offshore Geophysical Permit Program; OSCP = Oil Spill Contingency Plan; USCG = U.S. Coast Guard